Chapter 3

Performance Measurements for Complete Corridors

Introduction

Traditionally, the success of a roadway project has been measured in a single dimension, its functional appropriateness. Although that measurement is still insightful, adding another four dimensions will bring a better understanding of how society will measure the success of an overall roadway corridor.

The concept of Five Measures of Success was originally developed in 2005 by HNTB Corporation for the Michigan Department of Transportation's Context Sensitive Solutions Awareness Training. The five dimensions for measuring the success of a complete corridor include:

- **Functional Appropriateness:** Improved safety, mobility, and access for all modes
- **Community Support:** Better public, regulatory, and political support for specific projects and transportation in general
- **Environmental Compliance:** Enhanced environmental quality and ecological health
- **Financial Feasibility:** Superior cost/benefit ratios, jointly funded with shared obligations for design and construction costs with a stable revenue stream for operations and maintenance
- **Social and Economic Progress:** Increased economic and community development with quality of life and social vitality as indicators

The agencies responsible for developing our continent's highway system are well equipped to measure functional appropriateness using traditional measurements of safety, mobility, and access. This they know how to do and they do it with zeal. Landscape architecture and environmental design sensibility can add additional knowledge about how to measure the other dimensions or even why they should be concerned with their measurement.

What follows is an outline of how an agency could begin to use these performance measurements to its advantage. Only by having good data on what works and why it works can an effective complete corridor program progress. If these measurements are routinely gathered and analyzed for every project it will help ensure that highway a particular concept leads successfully to a complete corridor.

3.1 Functional Appropriateness

Traditionally the success of a roadway improvement project has been measured by comparing how well a highway functions after construction to how well it performed

Contrary to expectations, fewer collisions may occur on substandard roads Photo: http://www.co.washington.or.us/sheriff/media/photos/h2_wreck.jpg

before construction. Standard methods for measuring safety, mobility, and access are typically considered.

The public expects that all roadway improvement projects result in a least one type of functional improvement, and typically two: safety and mobility. (Frequently a reduction in access that leads to an improvement in safety or mobility is also generally acceptable except to those specifically inconvenienced.) Although these measurements would seem rather straight forward, in fact they are frequently misunderstood and misapplied, especially measurements for safety.

Safety

It is important that what is measured is not the improvement itself but rather the change in a road's "behavior." For example, a road may be considered "unsafe" because it is not up to a particular standard—its lanes may be too narrow, there may be curves that are too tight for road's functional type, shoulders may be unpaved, or it is deemed "deficient" and the agency declares that it should be improved.

Yet, the accidents that should be occurring are not. In fact, the road not only has less accidents but the accidents that do occur are less severe than a parallel road a few miles away that was recently brought up to standards. Both roads have the same type and volumes of traffic, serve the same community, have similar access and mobility characteristics but the substandard road performs better in terms of safety. Why?

Why? Because people are active participants, not billiard balls. They think. They react. They generally understand hazards and respond accordingly. Driving isn't about applying the laws of physics; it's about applying what many transportation engineers now call human factors. People see a road that looks safe and drive it accordingly, some a little too fast, even unsafe, and the result is a road where caution is less and accidents happen more than a road where caution is the rule. not observed

For nearly fifty years, the standards set for the interstate highway system have been held up as the highest standards of safety for all types of roads. They are not or at least not, necessarily. may not be It is critical that a proposed safety improvement to a highway will actually improve safety. It is not sufficient to claim that a road is substandard and that improving it will bring it up to standards.

Rather than improve a whole roadway, improve just the places where there are actual records of safety problems. Where are there accidents? What are the causes of those accidents? Would spot improvements solve the problem?

What is liberating about this approach is that many more miles of roadway that actually need safety improvements can be improved if money isn't spent reconstructing those segments of a road that are actually already safe and don't need to be improved.

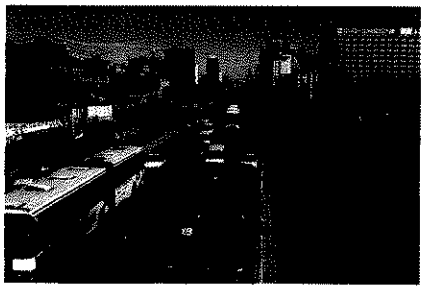
- **The Context Sensitive Solution:** Avoid bringing up a road to a particular standard to improve safety. Rather evaluate where safety problems occur and fix just the problem, saving time and money, reducing social and environmental impacts, and inconveniencing the traveling public less.

attentive

specifically

therefore

Mobility



The Daily Commute
Photo: http://blogs.move.com/first-time-home-buyers/wp-content/blogs.dir/21/files/2007/08/traffic.jpg

Congestion in North America has been increasing dramatically. As more motor vehicles join the daily commute in our larger cities, the more traffic slows down. Yet the national average commute time has stayed roughly the same for nearly 100 years, around 20 to 25 minutes. People seem to adjust their individual commutes—either changing jobs or changing where they live—to maintain a rather constant commute.

Although time has stayed essentially the same, the distance we commute has not. Fast moving freeway traffic has allowed us to expand how far we can go in those 20 to 25 minutes. As long as traffic is moving fast, freeways seems to work but as the road becomes more congested we try to cope by finding a new route, adjust our commuting times, or changing jobs or homes.

Another demographic phenomenon complicates this picture—the size of our households has been decreasing.

The issue is that every household has a base need for travel, regardless of how many individuals are in the household. Although trips to work may be better understood at an individual level, many trips—such as trips to the grocery store, to the veterinarian, and to the dry cleaners—are typically done per household. The more households, the less efficiently our highway system is used.

More households. More trips. More congestion.

This is why congestion is increasing faster than the population. In some major cities, the average household size has decreased from nearly four people in the 1950s to less than two today. Although population has dropped significantly in most cities across the country in the past fifty years, in some of those cities the number of households is actually rising again. With the increase in households, there are more trips and more congestion.

The transportation authority responds to congestion by planning, designing, and constructing additional capacity, typically more lanes in a particular corridor. But the solution is frequently short-lived and congestion re-occurs.

There have been many innovative answers to this dilemma. Urban planners tend to suggest improving transit or creating self-contained neighborhoods where people don't commute long distances but rather bicycle or walk a short distance to work, stopping to shop for all their necessities on their way home. Although many people have embraced this life-style, many, in fact most, have not, especially families with children.

Still there is a partial solution here. Increasing transit, improving bicycling routes, and making walking safe and inviting will decrease trips in motor vehicles and help decrease congestion.

Fortunately, the federal government has conducted an experiment to test this notion in our nation's capital, Washington, DC. Imagine what the District would look like if freeways had been built to move people instead of the Metro system. Some may think that as the center of government, the District would have remained vital, that trendy upscale neighborhoods would have become trendy and upscale even if the

freeways would have replaced the subway system. But there are scores of state capitals that used freeways as almost their exclusive means of moving people, to prove that being the center of government, even in large prosperous states, does not necessarily generate a vibrant urban core.

Highways, but especially urban freeways, demand a considerable amount of space for the number of people they move. Transit, bicycling, and walking use space much more efficiently resulting in compact communities, less energy being used, and less adverse impacts to environmental quality.

A technical solution to the mobility dilemma may soon be offered by innovative motor vehicle companies—a solution that would allow vehicles to be spaced closer together at fast speeds through the use of smart vehicles, perhaps easily tripling the capacity of any single lane.

- **The Context Sensitive Solution:** Plan and design for multiple modes to improve system-wide mobility. Alternative modes for moving people, particularly transit, bicycles, and pedestrians, need to run both parallel to the highway and across it, forming a multimodal network, with each mode complementing and supporting the others. The more modes, the better. Lastly, be prepared to embrace emerging technology that will enhance mobility by increasing the capacity of existing lanes.

Access

Measuring access is important for a complete corridor. Access is not equal on most roadways. Some neighborhoods, some business districts, some properties have better access and flourish. Others have less access and become less attractive for development. The placement of access needs to be considered a prime community development tool and should be coordinated with the local jurisdiction. The measurement should be how well the access proposed by the transportation agency matches the need for access as defined by the community's planning documents.

The amount and location of access directly affects safety and mobility. Access, therefore, must be considered early during planning stages of any corridor. The transportation planner should work with community planners to optimize land-use, density, and other community planning factors so the roadway system is not overwhelmed by the demands of adjacent development.

Access for all modes is essential. Designing for improved mobility and access for motor vehicles cannot be detrimental to the access already enjoyed by bicyclists and pedestrians, especially access across a major roadway corridor. The roadway planner and designer should examine at the existing transit, bicycle, and pedestrian systems, to determine how the proposed project can help complete or extend these systems.

- **The Context Sensitive Solution:** Provide access for all modes of transportation within and across the highway corridor, especially transit, bicyclists, and pedestrians. Work with community planners to coordinate the location of access from a roadway with the community's vision for the corridor and any master plans already developed.

3.2 Community Support

Charettes get the public involved in the design process
Photo: http://reslifeweb.memphis.edu/reslife/LivingCommunities/ARCH_House_01.jpg

Charettes get the public involved in the design process
Photo: http://www.smartgrowth.bc.ca/Portals/0/Images/CortesCharrette.jpg

Transportation agencies have made tremendous strides in the past two decades trying to engage the public in its planning and design processes. Through the widespread use of Context Sensitive Solutions, agencies now routinely ascertain the issues a community has related to any particular corridor. By engaging the public early, often and frequently through construction, highway agencies have improved their relationship with the public. Typically the public, through representatives on an advisory committee, define the issues, generate a vision or goals for the corridor, develop a set of measurable objectives and frequently participate in the development of a set of design guidelines. They also may review and comment on preliminary plans and help communicate project progress to their constituents.

The public is considered a stakeholder—someone or some group that has an interest in the outcome of the planning and design process. Typically the public is represented by a number of stakeholders—residents, business owners, school districts, public safety personnel, the parks department, municipal authorities, and staff from regulatory agencies ~~for example~~. The concept of public engagement is to generate support for the decision-making process and ultimately support for the decision itself, an ownership role.

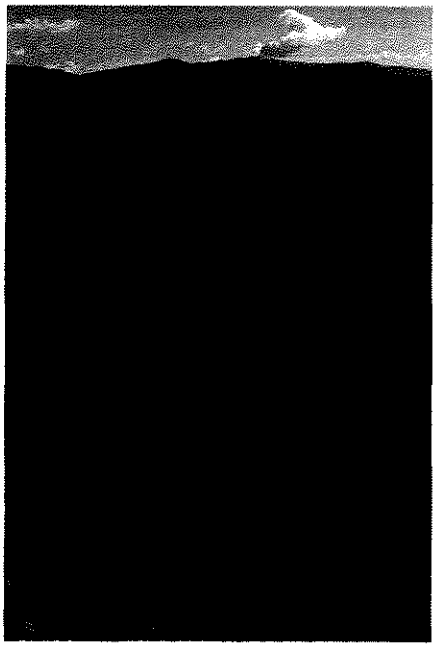
Some stakeholders have other roles besides contributing to an advisory committee. Some can become partners in the development of a corridor. In fact the more that the transportation project can be thought of in terms of a corridor project, the more the responsibility for its success can be shared with other stakeholders.

Regulators or a unit of local government, for example, rather than reacting to a proposal, help shape it, frequently defining the project scope so that the construction of the project also accomplishes a goal the regulator or local governmental unit has established as part of its mission—something that if done in cooperation can be achieved for less cost, in less time, and with less disruption than if both parties preceded independently. From a transportation agency perspective this makes regulators and other units of government design partners and potentially another source of funds. As partners, they will ~~thoroughly~~ heavily understand the constraints that the transportation agency is operating under, the extent to which alternatives have been explored, and why a particular approach to mitigation was chosen, shortening review times and accelerating approvals.

Transportation agencies, except in the creation of Scenic Byways and Parkways, have not seen a reason for extending the life of corridor advisory groups indefinitely.

This is unfortunate; much could be learned from the Scenic Byways model. A perpetual advisory committee could monitor the effectiveness of mitigation and enhancement in fulfilling the long-term vision and goals of the project. It could be used to attract additional funding for supplemental and even maintenance type projects. Most importantly, a perpetual advisory committee would become advocates for not only their corridor and the open planning and design process that was employed but also for the Department of Transportation that supported their efforts and ~~their~~ corridor.

A perpetual advisory committee would be an effective way to measure success. In particular, a perpetual advisory committee would be in the unique position to offer elected officials a candid assessment of the value of the state's transportation program has had for their community.



I-70 Glenwood Canyon improved environmental quality
Photo: Joseph J. Kracum

• The Context Sensitive Solution: By engaging all stakeholders early, often, and in perpetuity, a transportation agency will be in a better position to understand all of the corridor issues, establish goals and objectives for the project, evaluate potential alternatives, and how best to mitigate adverse impacts. Use the knowledge possessed by stakeholders, especially regulators and municipal authorities, to create design and financial partners. Be willing to extend the life of the Advisory Committee past construction into operations and maintenance so they become an advocate for the corridor, the transportation agency, and the state's transportation program.

3.3 Environmental Compliance

Environmental issues are a major concern of the public. Although roadways have been frequently considered an environmental affront, this is not necessarily a foregone fact. From the Bronx River Parkway to I-70 in Glenwood Canyon, highway projects have been used to improve environmental quality. Certainly easing congestion improves air and water quality but noise may increase unless other mitigative measures are implemented.

This requires creativity. Fortunately, the corridor planner or designer is not alone. If they have engaged all stakeholders, someone from a pollution control agency must be a partner. Recruiting them to help a transportation agency reduce its environmental footprint will not be difficult. For someone dedicating their lives to pollution control, one of their primary goals, typically both professionally and personally, is to make society and particularly its government, more environmentally friendly. Asking them to assist in reducing the environmental footprint of a transportation project or program will result in a rush of ideas and suggestions that additional assistance be sought from other regulators.

Essentially the stakeholders become the interdisciplinary team of designers required to truly develop that unique set of context sensitive solutions that form a complete corridor.

A road can and should improve the environment. It is important for the planner and designer to ask what regulatory agencies are attempting to do in this corridor or what they wish they could do if resources (money and people) were not a ~~problem~~. A simple stream crossing is enhanced to allow fish to migrate. Bluebird nesting boxes are added to signs or rail posts. Drainage onto a state right of way is altered to create wetlands upstream. Overland drainage is used rather than pipes to reduce runoff velocity and improve water quality. Wildflowers are added for beauty and soil stabilization but also become needed habitat bees and butterflies.

These are small items but new ideas on how to design ~~pavement~~ to improve air quality or reduce noise are being developed. Plants as filters to improve both air and water quality. New lighting technology to reduce energy consumption or new reflective sign material eliminating the need to light signs. The use of recycled materials and how to design so recycling is easy are all part of a green approach to construction.

• **The Context Sensitive Solution:** Although environmental compliance is a requirement it still must be measured more methodically and periodically than it is currently. Are the mitigations implemented as part of this project working as expected, especially over the long term—twenty to forty years? What actions would regulators like to pursue even if the highway

was not to be built? How can the knowledge of stakeholders, especially environmental regulators be tapped to develop innovative approaches to ecological problems? How can these and other innovations be incorporated into the design of the highway to improve existing environmental quality and ecological health?

3.4 Financial Feasibility

Across the country, costs for materials and construction are escalating out of portion to the ability of agencies to secure funding. As fuel efficiency rises, revenues, tied to gas taxes, decrease even as vehicular miles increase. Governments unwilling to raise taxes allow roads and bridges to deteriorate. A few raise taxes and fees on fuel, on registration, on services, or replaceable equipment such as tires and batteries. Others seek remedies by selling assets to investors who then toll the facility, trying to match revenue with capital, operational, and maintenance expenses.

Electronic tolling improves the efficiency of tolling operations and offers a glimmer of a potential future—a smart box in every car linked to a GPS database that records where and when a vehicle travels. When the vehicle is filled with gas, the smart box tells the pump (which relays the message) what roads were used and proportionally which transportation authority should get the fuel taxes, adjusted for congestion, it is now being charged.

Other ideas change the funding structure completely relying on more integration between transportation agencies and those agencies regulating land development. Recognizing that a government-built roadway is a significant investment that in turn significantly increases the value of adjacent property, some governmental units are experimenting with taxing the increase value of property caused by highway (and other infrastructure) construction. The theory being that as the value of land goes up, it is to the owner's advantage to increase the density of human occupation, to cover the taxes. Commercial centers and highly dense residential structures naturally migrate to these corridors. Modified versions of this, such as a special taxing district, ensure that there will be monies available not only to construct but also to maintain and operate the corridor.

A more traditional approach is one of cost sharing between units of government. If for example, a state highway would typically install a davit pole with a mercury vapor cobra head as a light fixture on a bridge that also serves as a gateway to a community and the community wanted a fixture that was more ornamental, the state would agree to allow the placement of the community's fixture provided the community pay for any extra installation cost and also agrees to either fund or perform any future maintenance required. For all parties, it is important to get such agreements signed early in the preliminary design phase to avoid re-work or unmet expectations.

Yet, probably the best way to manage costs is to plan, design, and build only those facilities that stakeholders support. As previously discussed, sometimes millions of dollars can be saved by solving problems rather than simply implementing standards.

- **The Context Sensitive Solution:** Work with other stakeholders to first define what is a reasonable project and then to identify funding responsibilities and sources not only for construction but for long-term maintenance and operation of the road and all the mitigative amenities that were part of the solution.

3.5 Social and Economic Progress

Before there was a federal Department of Transportation and a Federal Highway Administration, there was the Bureau of Public Roads and it was housed in the Department of Commerce. At one time we seemed to understand that roads were built to further social and economic progress. As a nation we have lost that notion, perhaps because as a nation we are no longer sure of progress itself. Nonetheless, it is what actually motivates the construction of roads.

No one plans, designs, and constructs a roadway so their community will be the worse off for it. The unspoken goal is to increase economic and community development. The issue has been that sometimes the benefits are aligned with one group of people—the travelers—and some other group, usually poor minority neighbors, is saddled with the social and personal costs.

In urban areas, new roads were constructed as part of the interstate system on what was relatively cheap land—land which was also frequently where the homes of low income minorities were situated. The affect was the dividing of many communities. The grid system of city blocks was broken with streets crossing the freeway only every half mile instead of every block. Communities where most people walked or used transit were severely crippled by the lack of connections.

Even if there were connections they would frequently be inadequate—a three foot sidewalk adjacent to a very busy street. A sidewalk overhung with traffic signs, without curbcut ramps, and piled with snow in the winter. If roads are going to benefit ~~one group~~ they must benefit all groups. A transportation planner and designer needs to understand a community's fabric and ask how can this project mend any tear in that fabric?

A transportation planner and designer must also understand the values and plans that a community has for its development and adjust access and mobility around those plans or work to modify the development plans so both travelers and neighbors benefit. How can the roadway's aesthetics contribute to a community's identify? How can it act as a community gateway? How can routes to destinations be maintained or even expanded? How will this road improve mobility and access to adjacent property and induce economic development? How can that economic development be funneled maintain existing institutions and to assure continued community development?

Again, working with stakeholder partners will be the key to unlocking the potential of those neighborhoods adjacent to the roadway. They, too, will know how to best measure success. Traditionally, academics might look for a decrease in crime, an increase in high-school graduation rates, or an increase in jobs in the neighborhood. From the neighbors we may find out that the real measure is how many people are barbequing in their backyard on a Friday Night in July.

- **The Context Sensitive Solution:** Using the skills and engaging the creativity of the project's partners help implement as part of the design of the project other goals for community and economic development that have already been articulated in other planning documents or are identified as part of the public engagement process. In particular, examine how access and mobility can assist in creating opportunities for new development or reinvigoration of existing development. Pay special heed to the aesthetics of the project since visual quality, especially cultural order, is used to judge the vitality of a community.

Conclusion

By expanding the measure of success to five attributes: Functional Appropriateness, Community Support, Environmental Compliance, Financial Feasibility, and Social and Economic Progress, the transportation planner or designer will be able to create a complete corridor—one that matches the expectations of stakeholders while remaining true to professional convictions.